

WHAT IS CLAIMED IS:

1. A method for detecting iron in the brain using magnetic resonance imaging (MRI) comprising:

generating a substantially high magnetic field strength within the MRI system;

5 acquiring magnetic resonance (MR) images by a pulse sequence adapted to create a magnetic field map of the brain for use in enhancing brain iron deposits; and,

characterizing regions of interest using the magnetic field maps to detect statistically relevant quantities of brain iron deposits to indicate a given disease.

10 2. The method of claim 1 wherein the selected pulse sequence is a dual gradient echo pulse sequence and the acquiring step is performed for two different echo times.

3. The method of claim 1 wherein the acquiring step generates a three dimensional phase image of the brain.

15 4. The method of claim 3 wherein the magnetic field map of the brain is created by fitting a spherical harmonic series to the three dimensional phase image of the brain.

20 5. The method of claim 4 further comprises subtracting the spherical harmonic series from the magnetic field map to provide a measure of local variation in the magnetic field in the brain.

6. The method of claim 1 wherein the brain iron deposits are indicative of diseases comprising Alzheimer's disease, Parkinson's disease, Huntington's disease, Hallervorden Spatz disease, other neurodegenerative diseases and atherosclerotic diseases.

25 7. The method of claim 1 wherein the substantially high magnetic field strength is about 1.5 Tesla (1.5 T) or greater.

8. The method of claim 1 further comprising repeating the acquiring and characterizing steps in at least one successive examination of a given subject for at least one of measuring progression of the disease and measuring response to therapy.

5 9. A system for detecting iron using magnetic resonance imaging (MRI) comprising:

 a magnetic resonance imaging device having a substantially high magnetic field strength and the device being adapted for acquiring magnetic resonance (MR) images by a pulse sequence adapted to create a magnetic field map of the brain
10 for use in enhancing brain iron deposits; and,

 an image processor coupled to the imaging device and adapted for characterizing regions of interest using the magnetic field map to detect iron deposits for use in at least one of diagnosis, prognosis, and prediction of progression of iron-dependent diseases.

15 10. The system of claim 9 wherein the substantially high magnetic field strength is about 1.5 Tesla (1.5 T) and greater.

 11. The system of claim 9 wherein the iron-dependent diseases comprise Alzheimer's Disease, Parkinson's Disease, Huntington's Disease, Hallervorden Spatz disease, other neurodegenerative diseases, liver diseases and
20 atherosclerotic diseases.

 12. The system of claim 9 wherein the selected pulse sequence is a dual gradient echo pulse sequence and the acquiring step is performed for two different echo times.

 13. The system of claim 9 wherein the MR images create a three
25 dimensional phase image of the brain.

14. The system of claim 13 wherein the magnetic field map of the brain is created by fitting a spherical harmonic series to the three dimensional phase image of the brain.

5 15. The system of claim 14 further comprises subtracting the spherical harmonic series from the magnetic field map to provide a measure of local variation in the magnetic field in the brain.